Clusia rosea Jacq. Cupey

Clusiaceae Clusia family

John K. Francis

JAN 20 1993
FORESTRY LIBRARY

SO-ITF-SM-69
December 1993

Clusia rosea Jacq., commonly known as cupey (Spanish), pitch-apple (English), and figuc mawon[1] (Creole) (*9, 17*), is a medium-sized tree with thick, dark-green leaves and numerous aerial and prop roots (fig. 1). Found in the Caribbean, cupey develops a vine-like habit on cliffs and a banyan-like habit in open areas (fig. 2). Trees beginning as epiphytes can strangle or smother their hosts over a period of many years. The wood is of little use, but the species is important as an ornamental and as a source of wildlife food. It also provides forest cover on cliffs and rock outcrops.

HABITAT

Native Range

The native range of cupey (fig. 3) includes the Florida Keys, the islands of Andros, New Providence, Inagua, and East Caicos in the Bahamas, the Greater Antilles, St. Thomas, St. John, and Tortola in the U.S. Virgin Islands, Anguilla, and St. Martin in the Lesser Antilles (*4, 9, 10, 11*). Cupey was observed in the past on St. Croix but has not been reported there in recent times (*11*). There have been reports of cupey growing in Central and South America. However, an examination of herbarium specimens from Central America, South America, and Trinidad showed that these are actually other species of *Clusia (9).*

Climate

The maritime climate of the Caribbean where cupey is found is moist and warm. In Puerto Rico, cupey grows in forests receiving from about 750 to 3000 mm of mean annual precipitation. In Haiti, the species is reported to grow in areas that receive from 600 to 1250 mm of annual precipitation.[1] In the areas of less precipitation, cupey tends to grow near streams, intermittent streams, and moist coves. A dry season of 2 or 3 months duration occurs in most of the native range. Mean annual temperatures near sea level range from about 24.5 °C in the Florida Keys to about 27.0 °C in St. Martin (*19*). Frosts do not occur in the native range.

Soils and Topography

Cupey appears to be insensitive to variations in soil properties. Cupey trees may be found growing on Inceptisols near the ocean that commonly have pH's of 8.0 and on Ultisols and Oxisols that may have pH's below 5.0 (author, personal observation). Soil textures may also vary from sands to clays. The tree is most frequently seen in shallow, rocky soils in moist areas.[1] Cupey is resistant to mild salt spray (*11*). The trees observed by the author having the best developed stems grew on midslopes of moist limestone hills. Cupey grows on all slopes from vertical cliff faces to level coastal flats. Elevation varies from sea level to as high as 1,200 m (in Haiti).[1]

Figure 1.—*Trunk and aerial roots of a cupey tree* (Clusia rosea) *growing in a Puerto Rican moist forest.*

[1]Jenkins, Michael B. 1988. The useful trees of Haiti; a selected review. 238 p. Unpublished manuscript on file with: International Institute of Tropical Forestry, U.S. Department of Agriculture, Forest Service, Río Piedras, PR 00928-2500.

John K. Francis is a research forester at the International Institute of Tropical Forestry, U.S. Department of Agriculture, Forest Service, Río Piedras, PR 00928-2500; in cooperation with the University of Puerto Rico, Río Piedras, PR 00936-4984.

Associated Forest Cover

A dry limestone plateau in Cuba contained cupey growing in association with *Dendrocereus nudiflorus* (Engelm.) Britt. & Rose, *Guaiacum sanctum* L., *Lysiloma latisiliqua* A. Gray ex Sauv., and *Phyllostylon brasiliensis* Capanema (*14*). On the cliff faces in moist limestone hills, cupey competes with *Ficus citrifolia* Mill., *F. crassinervia* Desf., and *F. stahlii* Warb. (*5*). A swampy forest coastal type in Puerto Rico that showed some evidence of past cutting was dominated by cupey (81 percent of the basal area) and also contained significant basal areas of *Syzygium jambos* (L.) Alst., and *Ocotea leucoxylon* (Sw.) Mez (*7*).

LIFE HISTORY

Reproduction and Early Growth

Flowering and Fruiting.—Flowering occurs only in dominant or codominant cupey trees. Although flowering and fruiting are synchronized within individual trees, scattered trees can be found flowering at any time of the year (*11*). The large and showy flower petals are white, tinged with pink. The fruits, reputed to be poisonous to humans (*16*), are eaten by bats (*11*). A sample of 58 fruits collected in Puerto Rico had an average weight of 71 g per fruit.[2] The outer covering of the fruit splits from the tip halfway to the stem end along 8 to 10 lines and opens like a flower to expose a central core with 7 to 9 seed-filled grooves. Each groove may contain up to 12 yellow seeds that are covered with a sticky red-orange pulp (aril).

Seed Production and Dissemination.—Fruiting cupey trees produce seeds in large numbers. One seed collection in Puerto Rico averaged 84,000 seeds per kg (author, personal observation). Seeds are dispersed by gravity and birds (author, personal observation).

[2]Wadsworth, Frank H. 1945. Report on preliminary seed weighing of cupey. Final report 646 on file with: U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, Río Piedras, PR 00928-2500.

Seedling Development.—Germination is epigeous and can proceed in or on the fallen fruit, but is much more successful if seeds are dispersed to other substrates. Seeds placed on moist peat had 85-percent germination, whereas only 2 percent of seeds placed on pieces of rotting cupey fruit germinated (author, personal observation).

A group of 14 seedlings averaged 26 cm in height after 1 year and 43 cm after 15 months from the sowing date (author, personal observation). Cupey seedlings can be grown in full sun or light shade and can be outplanted at any growth stage. Occasional drought in nursery beds or containers is not harmful. Seedlings, saplings, and even small trees can be transplanted with little mortality (*2*). Because cupey seedlings grow slowly, a principal consideration in new plantings should be weed control. While ornamental plantings are common, no forestry plantations are known. Natural cupey seedlings can become established on at least three types of substrate: in soil on the forest floor, as an epiphyte in crowns of other trees, and on rocks and cliff faces. Because of a moderate growth rate, lack of commercial markets for cupey wood, and the frequency of wild cupey seedlings, it is probably adequate to rely on natural reproduction to regenerate the species.

Vegetative Reproduction.—Because branches grow aerial roots that become stems if allowed to grow long enough, cupey trees can form clonal stands in much the same way as do many tropical figs (*Ficus* spp.). Competition from surrounding trees usually prevents this condition from occurring in natural forests, but it has been observed in open-grown trees. One 40-year-old cupey tree on the grounds of the International Institute of Tropical Forestry, Río Piedras, PR, covers approximately 0.06 ha and has 155 stems more than 2 cm in d.b.h. (author, personal observation).

Young cupey will coppice if cut. Aerial and prop roots occasionally sprout leaves when severed and thus remain as clonal plants. Layering of branches that touch the ground is common. Twenty-six percent of untreated branch cuttings with one leaf attached placed in pots rooted in about 6 months; aerial root segments tested in the same way failed to root (author, personal observation).

Figure 2.—*An open-grown cupey* (Clusia rosea) *showing its banyon-like habit.*

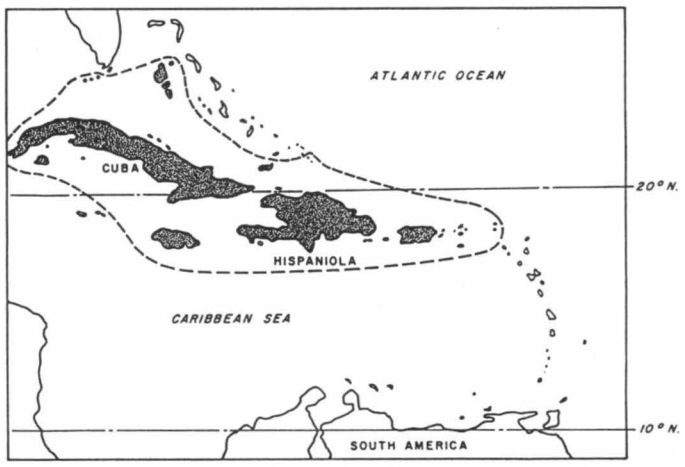

Figure 3.—*The native range of cupey* (Clusia rosea) *in the Caribbean indicated by the shaded area.*

Sapling and Pole Stage to Maturity

Growth and Yield.—Little is known about the growth rate of cupey except that it appears to have an intermediate growth rate for tropical trees (*2*). The open-grown ornamental cupey tree on the grounds of the International Institute of Tropical Forestry produced many stems, but the largest measured only 32 cm in d.b.h. Cupey trees on good sites in high forests occasionally have single, well-formed stems that reach 0.5 m in d.b.h. (author, personal observation). Judging from the age of moist secondary forests where cupey trees are found in Puerto Rico, trees of this size must take about 60 years to grow. Cupey, which formed a small part of a slow-growing dry forest stand in St. John, U.S. Virgin Islands, increased 0.07 cm per year in d.b.h. over a 5-year period (*21*).

The metabolism of cupey is unusual in that it is able to switch back and forth from ordinary C3-photosynthesis to Crassulacean acid metabolism (CAM) depending on the amount of available moisture (*18*). This ability apparently enables cupey to grow like other C3 plants under moist conditions and to continue growing, like succulent plants, during droughts.

Cupey has a reputation for strangling its hosts (*11, 14, 17*). The process does indeed occur (photographic proof is shown in *14*); but, of the thousands of cupeys observed by the author, just one had developed the specialized strangling roots required to kill its host. It is much more common for cupey to simply smother the trees they grow on as the older host trees decline and the younger cupey trees grow larger. In rocky areas, the common means of establishing themselves is to send down aerial roots to the soil from rocks or cliffs where the cupey seedlings have germinated (*5*). Seedlings starting on the forest floor occasionally reach the canopy, especially in dry forests, if aided by disturbance.

Rooting Habit.—The first seedling roots quickly lose geotropism and become indistinguishable from early lateral roots. Adult cupey trees do not root deeply (*2*) and probably do not have taproots. There are no buttresses, but prop roots and roots descending from major limbs are typical. The original stem and root system is supplemented, and sometimes superseded, by root systems developing from aerial roots that have become stems (author, personal observation).

Seedlings that germinate in crotches of trees or on rocks begin to drop an aerial root to the soil after producing about six leaves. As this distance is often 20 m or more, it may take several years for the root to reach the soil. These cord-like roots maintain a fairly constant 6- to 8-mm diameter until they reach the soil and begin developing into stems. They are reddish orange near the growing tip and gradually acquire a barky surface, a gray-brown color, and protruding lenticels (author, personal observation).

Reaction to Competition.—Cupey is moderately tolerant of shade. Seedlings and saplings survive for many years in the understory of moist secondary forests. However, growth is so slow that few make it into the overstory. The more common means of establishment in closed forests is as an epiphyte. Cupey trees find little competition on bare rock outcrops and rock faces. Because of the frequency of cliffs and rock outcrops in the moist limestone hills of Puerto Rico, cupey is more abundant there than in other areas of the island (author, personal observation).

Four sample plots in three moist forest stands that contained cupey in Puerto Rico averaged 25 m^2/ha of which cupey contributed 8 m^2/ha including aerial roots that have turned into stems. Of the average total of 2,300 stems per hectare, 255 were cupey. Of course, not all stands contain cupey. In a survey of forest cover in a privately-owned secondary forest in central Puerto Rico, cupey accounted for 0.8 percent of the basal area, the 26th most important species in terms of basal area (*3*). Basal area of cupey stems under a large tree covering 0.06 ha was 28 m^2/ha (author, personal observation). The crowns of cupey cast a dense shade so that few tree seedlings survive long beneath them.

Damaging Agents.—Although several insect species have been collected on cupey, none were noted to cause significant damage (*15*). Wet-wood termites, *Nasutitermes costalis* (Holmgren), frequently build nests in, or trails into, cupey crowns and feed on dead branches, twigs, and leaves (*15*; author, personal observation). The wood is very susceptible to attack by ambrosia beetles (species unidentified) (*12*) and dry-wood termites, *Cryptotermes brevis* (Walker) (*22*). The wood is not attacked by sapstain fungi during seasoning (*12*).

Cupey is susceptible to windthrow (*20*) and breakage (author, personal observation) in hurricanes, apparently because it does not defoliate and must bear the full force of the wind. Mortality of thrown and badly broken trees is high, and recovery of moderately damaged trees is slow (author, personal observation). Hurricanes and slow growth rate are probably the limiting factors that prevent cupeys from dominating many sites in moist forests.

The limited ability of cupey to recover from damage suggests that cutting or girdling the trees may be sufficient to eliminate them from forest stands during cleaning operations. However, cutting the vine-like roots of epiphytic cupey saplings will not kill them.

SPECIAL USES

Because of their straightness, cupey's aerial roots were employed by indigenous tribes as lance shafts (*6*). Cut off from an outside source of cardboard and paper, the early Spanish substituted the leaves of cupey. They made playing cards and wrote messages on green cupey leaves—the images and words remained after the leaves dried (*11*). Various preparations of cupey were used in folk medicine to treat several different conditions (*16*). There are no reports, however, of scientific testing of cupey for pharmacological activity.

Cupey wood is heavy, hard, and strong. The heartwood is straight grained, without rings or prominent features; it is reddish brown to dark tan. The sapwood is lighter and merges gradually with the heartwood (*12*). The heartwood is heavy and hard with an air-dried density of 0.74 g/cm^2 (author, personal observation). Samples from an aerial root-turned-stem averaged 0.68 g/cm^2 (author, personal observation). Cupey wood seasons at a moderate rate with a moderate amount of degrade due to warp and surface checks. Shrinkage is 2.1 percent radial and 4.7 percent tangential when dried to a 15-percent moisture content. The wood is moderately difficult to saw and machine and accepts screws without splitting. Uses of cupey wood are generally limited to firewood, charcoal, fenceposts, and rural construction (*12*). The wood is suited to many purposes requiring a heavy,

UNIVERSITY OF MINNESOTA
3 1951 D02 980 891 B

strong wood, but the relative rarity of quality sawlogs and the moderate difficulties in seasoning and machining will probably preclude this species from commercial use.

The orange pulp surrounding the seeds is a food for birds, and the fruits are eaten by bats (*1*). Cupey contributes to the floristic diversity of moist forests and helps provide forest cover, particularly on rock outcrops and cliff faces. The species is frequently used as an ornamental, as a shrub for esthetics, and as a landscaping tree in large, open spaces. Slow growth, production of very little litter, and unusual leaf shape and color all contribute to its appeal. The flowers are large and attractive but are produced only after the plant has reached tree size.

GENETICS

Cupey is functionally apomictic; it produces only pistillate flowers, which need no pollination for fruit and seed development (*9, 13*). Genetic variation in cupey is evident by differences in leaf shape and stem form. A variegated variety, "aureo-variegata," is cultivated as an ornamental (*8*). *Clusia* is a genus of over 150 species of trees, shrubs, and vines that range throughout the Antilles, Central America, and South America (*9*). The genus has not been adequately studied; new species and varieties probably remain to be identified.

LITERATURE CITED

1. Anglero, José I. 1959. Información sobre árboles ornamentales y de sombra. Río Piedras, PR: Universidad de Puerto Rico, Servicio de Extensión Agrícola. [Not paged].
2. Aristeguieta, Leandro. 1962. Arboles ornamentales de Caracas. Caracas, Venezuela: Consejo de Desarrollo Cientifico y Humanístico, Universidad Central de Venezuela. 218 p.
3. Birdsey, Richard A.; Weaver, Peter L. 1982. The forest resources of Puerto Rico. Resour. Bull. SO-85. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 59 p.
4. Britton, Nathaniel Lord; Millspaugh, Charles Frederick. 1920. The Bahama flora. New York: Nathaniel Lord Britton and Charles Fredrick Millspaugh. 695 p.
5. Chinea, Jesus Danilo. 1980. The forest vegetation of the limestone hills of northern Puerto Rico. Ithaca, NY: Cornell University. 70 p. M.S. thesis.
6. Domínguez Cristóbal, Carlos M. 1989. La situación forestal Pre-Hispánica de Puerto Rico. Acta Científica. 3(2-3): 63–66.
7. Figueroa, Julio C.; Totti, Luis; Lugo, Ariel E.; Woodbury, Roy O. 1984. Structure and composition of moist coastal forests in Dorado, Puerto Rico. Res. Pap. SO-202. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 11 p.
8. Graf, Alfred Byrd. 1959. Exotica 2. Rutherford, NJ: Roehrs Company. 1,146 p.
9. Howard, Richard A. 1989. Flora of the Lesser Antilles, Leeward and Windward Islands. Jamaica Plain, MA: Arnold Arboretum, Harvard University. 604 p. Vol. 5.
10. Little, Elbert L., Jr. 1979. Checklist of United States trees (native and naturalized). Agric. Handb. 541. Washington, DC: U.S. Department of Agriculture. 375 p.
11. Little, Elbert L., Jr.; Wadsworth, Frank H. 1964. Common trees of Puerto Rico and the Virgin Islands. Agric. Handb. 249. Washington, DC: U.S. Department of Agriculture. 548 p.
12. Longwood, Franklin R. 1961. Puerto Rican woods: their machining, seasoning and related characteristics. Agric. Handb. 205. Washington, DC: U.S. Department of Agriculture. 98 p.
13. Maguire, B. 1976. Apomixis in the genus *Clusia* (Clusiaceae).—A preliminary report. Taxon. 25(2/3): 241–244.
14. Marie-Victorin, Frère; Leon, Frère. 1942. Itinéraires botaniques dans l'île de Cuba. Contrib. 41. Montréal, Canada: Institut Botanique de L'Université de Montréal. 227 p.
15. Martorell, Luis F. 1975. Annotated food plant catalog of the insects of Puerto Rico. Río Piedras, PR: Agricultural Experiment Station, University of Puerto Rico. 303 p.
16. Roig y Mesa, Juan Tomás. 1945. Plantas medicinales, aromáticas o venenosas de Cuba. Havana, Cuba: Ministerio de Agricultura, Servicio de Publicidad y Divulgación. 872 p.
17. Schiffino, José. 1945. Riqueza forestal Dominicana. Trujillo, Dominican Republic: Editora Montalvo. 291 p. Vol. 1.
18. Scmitt, A.K.; Lee, H.S.J.; Lüttge, U. 1988. The response of the C3-CAM tree, *Clusia rosea,* to light and water stress. 1: Gas exchange characteristics. Journal of Experimental Botany. 39(208): 1,581–1,590.
19. Steinhauser, F. 1979. Climatic atlas of North and Central America. Budapest, Hungary: World Meteorological Organization, UNESCO Cartographia. 31 maps.
20. Wadsworth, Frank H.; Englerth, George H. 1959. Effects of the 1956 hurricane on forests of Puerto Rico. Caribbean Forester. 20(3/4): 38–51.
21. Weaver, Peter L. 1990. Tree diameter growth rates in Cinnamon Bay Watershed, St. John, U.S. Virgin Islands. Caribbean Journal of Science. 26(1/2): 1–6.
22. Wolcott, George N. 1946. A list of woods arranged according to their resistance to the attack of the West Indian dry-wood termite, *Cryptotermes brevis* (Walker). Caribbean Forester. 7(4): 329–334.

*U.S. GOVERNMENT PRINTING OFFICE:1994-565-016/80044